Permit Fact Sheet

General Information

Permit Number:	WI-0021946-10-0	
Permittee Name:	CITY OF TOMAHAWK	
Address:	City Hall, PO Box 469	
City/State/Zip:	Tomahawk WI 54487	
Discharge Location:	W5846 Dean Road, Tomahawk, Wisconsin (SW ¼ NE ¼ of section 10; T34N-R6E)	
Receiving Water:	Treated wastewater is discharged to a wetland south of the facility. The effluent flows to the Wisconsin River along a channel (0.5 miles in length) constructed through a number of wetland complexes. The wetland is in the Noisy and Pine Creeks Watershed in the Upper Wisconsin River Drainage Basin, Lincoln County.	
StreamFlow ($Q_{7,10}$):	0 cfs for Effluent Ditch; 750 cfs for Wisconsin River	
Stream Classification:	Wetlands and wastewater effluent channels are considered Limited Aquatic Life water bodies subject to the requirements in NR 104.02(3)(b). In addition, consideration for downstream impacts to the Wisconsin River (Fish & Aquatic Life - Warm Water Sport Fish Community) need to be considered for ammonia, phosphorus and effluent temperature. Effluent discharges enter the Wisconsin River at mile 312.2 in Segment A.	
Wild Rice Impacts:	No impacts identified. Wild rice has been confirmed downstream of Tomahawk, but distribution of the wild rice beds is difficult to characterize. • The waste meets NR 105.04 Wis. Adm. Code • The wastewater permit has been in existence over a long period • The effluent volumes are low in comparison to receiving water.	
Design Flow(s)	Daily Maximum	1.27 MGD
	Weekly Maximum	1.01 MGD
	Monthly Maximum	0.726 MGD
	Annual Average	0.60 MGD
Significant Industrial Loading?	No	
Operator at Proper Grade?	Yes	
Approved Pretreatment Program?	N/A	

Facility Description

The City of Tomahawk wastewater treatment facility serves a population of approximately 3,400 with no significant industrial contributors. The annual average design flow is 600,000 gallons per day with actual flows averaging 587,000 gallons per day over the past five years (Aug 2013 – Aug 2018 data). The facility is a conventional activated sludge wastewater treatment system. The system consists of debris removal (a mechanically cleaned fine screen with manual bar screening available when the fine screen needs to be bypassed and vortex grit separator) from the untreated wastewater (influent) prior to entering the treatment system. The influent enters the primary clarifier where solids are allowed to settle. As Tomahawk utilizes biological phosphorus removal it then flows into two selector tanks followed by three

aeration tanks (air added) where it mixes with activated sludge breaking down organic matter and biologically up taking phosphorus. Activated sludge is composed of settled solids containing naturally occurring bacteria recycled from the treatment system. Chemicals may be added if necessary to supplement the biological phosphorus removal process. The water is then pumped into a final clarifier where remaining solids are settled out. The settled solids (sludge) are removed from the clarifier, rotary thickened and then pumped to an anaerobic digester which stabilizes the sludge and reduces harmful pathogens to safe levels. Some of the sludge is returned to the aeration tanks from the final clarifier to re-seed the new wastewater entering the tank, while the rest of the sludge is stored until it is land applied on Department approved agricultural sites.

Prior to discharging the treated wastewater (effluent), Ultraviolet light is used seasonally (May through September) as a disinfectant to kill harmful bacteria. The effluent is discharged to a wetland south of the facility. The effluent flows about ½ mile to the Wisconsin River along a channel constructed through a number of wetland complexes. The channel was built specifically to convey the effluent to the Wisconsin River.

Substantial Compliance Determination

	Compliance?	Comments	
Discharge limits	Yes	All met and consistently well below concentration/loading limits in the permit.	
Sampling/testing requirements	Yes	All sampling conducted as required.	
Groundwater standards	N/A		
Reporting requirements	Yes	Timely reporting, requirements met.	
Compliance schedules	N/A		
Management plan	N/A		
Operator at proper grade	Yes	Dave Van De Weerd – Advanced; A1, B, C, D, L, P	
Other (CMOM)	Yes	Noted at facility by Ohm.	
Current Plant Subclasses	A1. Suspended Growth Processes (Activated Sludge); B. Solids Separation (Clarifiers, membranes, filters, etc); C. Sludge Treatment (Aerobic /anaerobic digestion, thickening, dewatering, land application); P. Total Phosphorus Removal; N. Total Nitrogen Removal; D. Disinfection; L. On-Site Laboratory Testing (Last audit closure letter February 16, 2018); SS. Sanitary Sewage Collection System		
Enforcement considerations	None		
In substantial compliance?	Yes	Treatment facility appears to be very well operated, testament to their dedication and hard work	
	Concurrence: Michael T. Goettel – WW, Superior		Date: 02/23/18

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)**
701	INFLUENT Flow is not a required parameter.	Representative samples shall be collected in the influent channel down stream of the grit removal system.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)**
001	EFFLUENT An average of 0.587 MGD (Aug 2013 – Aug 2018 data)	Representative samples shall be collected after the ultraviolet disinfection unit prior to discharge to the effluent ditch tributary to the Wisconsin River.
002	SLUDGE Approximately 40 dry US tons (data from application)	Samples for sludge shall be collected at a location and time appropriate for the specific test.
101 102 104	IN-PLANT Flow is not a required parameter.	In plant operational sampling reported on electronic Discharge Monitoring Report, but not required in the permit.
601	RECEIVING WATER Flow is not a required parameter.	Representative samples of the receiving water, the Wisconsin River, shall be collected from a point which is representative of the mixed receiving water and effluent at a point where chemical equilibrium has been reached.

1 Influent - Proposed Monitoring

Sample Point Number: 701- INFLUENT TO PLANT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
BOD5, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	3/Week	24-Hr Comp	

Changes from Previous Permit:

No changes from the previous permit. The parameters are standard monitoring requirements and frequency for minor municipal facilities with a mechanical treatment plant. Tracking of BOD_5, and Suspended Solids are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code.

Inplant - Proposed Monitoring and Limitations

Sample Point Number: 101- ANAEROBIC SLUDGE HAULED; 102- ANAEROBIC, and 104- GENERAL PLANT

Sample Point Number: 101- ANAEROBIC SLUDGE HAULED

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Sludge Withdrawn		gal	Daily	Measure	

Sample Point Number: 102- ANAEROBIC

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Sludge Pumpage Primary		gal	Daily	Measure	
Temperature, Digester		deg F	Daily	Measure	
Temperature, Digester Water In		deg F	Daily	Measure	
Temperature, Digester Water Out		deg F	Daily	Measure	
pH Digester		su	Daily	Measure	

Sample Point Number: 104- GENERAL PLANT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Precipitation		in/day	Daily	Measure	
Temperature, Air		deg F	Daily	Measure	
Dissolved Oxygen, Mixed Liquor		mg/L	Daily	Measure	
Suspended Solids, Mixed Liquor		mg/L	Daily	Measure	
Suspended Solids, Volatile Mixed Liquor		mg/L	Daily	Measure	

Changes from Previous Permit:

The parameters listed for Inplant monitoring are general operational parameter; it is not included in the permit. They are only listed on the electronic Discharge Monitoring Report (eDMR).

2 Surface Water - Proposed Monitoring and Limitations

Sample Point Number: 001- EFFLUENT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Continuous	Continuous	
BOD5, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	
BOD5, Total	Weekly Avg	30 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	30 mg/L	3/Week	24-Hr Flow Prop Comp	
pH Field	Daily Max	9.0 su	Daily	Grab	
pH Field	Daily Min	6.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	4.0 mg/L	3/Week	Grab	
Fecal Coliform	Geometric Mean - Monthly	400 #/100 ml	Weekly	Grab	Limit and monitoring required May through September.
Fecal Coliform	Geometric Mean - Wkly	656 #/100 ml	Weekly	Grab	Limit and monitoring required May through September.
Phosphorus, Total	Monthly Avg	1.0 mg/L	3/Week	24-Hr Flow Prop Comp	
WLA Previous Day River Flow		cfs	3/Week	Gauge Station	Monitoring required May through October. See the "Waste Load Allocation Requirements" subsection for more information.
WLA Previous Day River Temp		deg F	3/Week	Gauge Station	Monitoring required May through October. See the "Waste Load Allocation Requirements" subsection for more information.
BOD5, Variable Limit		lbs/day	3/Week	See Table	Monitoring required May through October. See the "Waste Load Allocation Requirements" subsection for more information.

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
WLA BOD5 Discharged	Daily Max - Variable	lbs/day	3/Week	Calculated	Monitoring required May through October. See the "Waste Load Allocation Requirements" subsection for more information.
Hardness, Total as CaCO3		mg/L	Quarterly	24-Hr Flow Prop Comp	Monitoring shall coincide with Copper monitoring.
Copper, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Chloride		mg/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required only during the 2022 calendar year.
Nitrogen, Ammonia (NH3-N) Total		mg/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required only during the 2022 calendar year.
Acute WET		TUa	Once	24-Hr Flow Prop Comp	One test is required April through June 2020.

Changes from Previous Permit

The monitoring frequency and limits for **Flow**, **BOD5**, **DO**, **Suspended Solids**, and **pH** have not changed from the previous permit term. All categorical limits are based on NR 104.02 and NR 210 (Subchapter II) Wis. Adm. Code. More information on calculating limits for these parameters as well as **Ammonia**, **Phosphorus**, **Temperature**, and **Disinfection** can be found in the "Water Quality-Based Effluent Limitations for the City of Tomahawk (WI-0021946)" memo dated July 13, 2018.

Fecal Coliform – Categorical limits for fecal coliform are found in NR 210.06 Wis. Adm. Code. Regulatory changes to s. NR 205.065, Wis. Adm. Code, became effective September 1, 2016. The rule requires limits in this permit to be expressed as weekly average and monthly average limits whenever practicable. These changes are based on 40 CFR 122.45(d). In order to comply with this regulation, a weekly geometric mean limit of 656 #/100 ml has been included.

BOD5 - The effluent has a wasteload allocation of 275 pounds per day for BOD_5 during the months from May through October, and is a function of the Wisconsin River flow and temperature per NR 212.60 Wis. Adm. Code.

Phosphorus – Phosphorus requirements are based on the Phosphorus Rules that became effective 12/1/2010 as detailed in NR 102 Water Quality Standards and NR 217 Effluent Standards and Limitations for Phosphorus. Chapter NR 217 of the Wis. Adm. Code addresses point source dischargers of phosphorus to surface waters. Currently in NR 217 Wis. Adm. Code there are two methods used to determine if a phosphorus limit is needed: a technology based effluent limit (TBEL) and a water quality based effluent limit (WQBEL). A TBEL of 1 mg/L is appropriate because the facility discharges more than the threshold of 150 pounds per month. Based on the size and classification of the Wisconsin River, the WQBEL is 42.4 mg/L. The TBEL is more protective than the WQBEL therefore remains in effect this permit term.

Phosphorus TMDL - A Total Maximum Daily Load (TMDL) is being developed for the Wisconsin River to address phosphorus water quality impairments within the TMDL area. This TMDL will likely result in limitations for phosphorus that must be included in WPDES permits, which may be different than those calculated for this permit reissuance. TMDL-derived limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.

Thermal – Using the administrative rules for thermal discharges detailed in NR 102 Subchapter II Water Quality Standards for Temperature and NR 106 Subchapter V Effluent Limitations for Temperature effective October 2010, effluent thermal limits were calculated. The calculated thermal limits for the Effluent Ditch indicate a daily maximum temperature limit of 120 degrees F. Effluent temperatures from activated sludge systems have not reported temperatures above 73 degrees F (the facility reported a maximum of 67 degrees F) and are not expected to reach the calculated limit(s), therefore, limits are not required this permit term.

Copper – Total recoverable limitations based on NR 105 Wis. Adm. Code were calculated for copper; a Daily Maximum (16.98 ug/L) and Weekly Average (7.44 ug/L). The effluent 1-day p99 of 13.3 ug/L is below the calculated limit, but the 4-day p99 of 9.15 ug/L is greater than the Weekly Average which would lead to inclusion of a limitation in the permit. Past instream data suggest that a calculated dissolved copper limit would be well above effluent levels, which would equate to no limits needed. No limits will be implemented this permit term to allow the facility time to conduct two rounds of sampling in the receiving water and to implement low level effluent metal sampling. The limitation will be re-evaluated for the next permit term. (See the Instream Monitoring section for more information.)

Chloride – The 1-day (167 mg/L) and 4-day (121.86 mg/L) P_{99} results of the chloride concentration are less than the calculated daily maximum (757 mg/L) and weekly average (395 mg/L) WQBELs based on NR 106 subchapter VII, therefore no effluent limits are needed. Monitoring is required monthly during the 2022 calendar year in preparation for the next permit reissuance.

Ammonia - Using current acute and chronic ammonia toxicity criteria found in Tables 2C and 4B of NR 105 Wis. Adm. Code (effective March 1, 2004) and limit calculating procedures (Subchapter IV of 106, Wis. Adm. Code (update effective September 1, 2016); ammonia limitations were calculated for the facility. Daily Maximum (89 mg/L), Weekly Average (49 mg/L) and Monthly Average (21mg/L) limits were considered, but it was determined effluent ammonia limits are not needed this permit term because the mean effluent ammonia concentration is 0.7 mg/L. Monitoring is required monthly during the 2022 calendar year in preparation for the next permit reissuance.

Acute Wet Testing - Based on historical WET test data and reasonable potential factor (RPF) calculations (NR 106.08 and NR 106.09 Wis. Adm. Code), WET limits are not required this permit term. A WET Checklist was prepared to determine the number of WET tests that are needed. As toxicity potential increases, more points accumulate, and more monitoring is required to assure toxicity is not occurring over the short (acute) and long (chronic) term. Based on the total points accumulated and Chapter 1.3 of the WET Guidance Document, WET Tests are not required this permit term. As part of the receiving water monitoring, one Acute WET test is required during second quarter 2020 during the period of instream samples.

Sample Point Number: 601- INSTREAM MONITORING - WI RIVER

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Copper, Total Recoverable		ug/L	See Listed Qtr(s)	Grab	Two samples are required over the permit term. See the "Receiving Water Monitoring" section for more information.
Copper Dissolved		ug/L	See Listed Qtr(s)	Grab	
Suspended Solids, Total		ug/L	See Listed Qtr(s)	Grab	

Changes from Previous Permit

This is a new sample point this permit term. Monitoring of the Wisconsin River for Total Recoverable Copper, Dissolved Copper and Total Suspended Solids is required twice, **once in the 2nd quarter (April – June) 2020** and **once in the 4th quarter (October – December) 2022**. Low level sampling and analysis required for copper shall be completed by a certified lab. Sampling methodology shall be consistent with EPA Method 1669: Sampling Ambient Water for Trace

Metals at EPA Water Quality Criteria Levels. Sample analysis shall be consistent with EPA Method 200.8: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry or a method that provides equivalent sensitivity. Collection of samples shall occur during base flow conditions, when no stormwater runoff events are taking place. These samples shall be collected concurrently with a monthly or quarterly effluent sample collected for copper or hardness, respectively. The information will be used to evaluate copper dissolved-based limits.

3 Land Application - Proposed Monitoring and Limitations

Municipal Sludge Description						
Sample Point	**Sludge Class (A or B)**	**Sludge Type (Liquid or Cake)**	**Pathogen Reduction Method**	**Vector Attraction Method**	**Reuse Option**	**Amount Reused/Disposed (Dry Tons/Year)**
002	B	Liquid	Fecal Coliform	Volatile Solids Reduction	Land Apply	40 dry tons/ year
Does sludge management demonstrate compliance? Yes						
Is additional sludge storage required? No						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? No, during the most recent round of sampling (2014), the gross alpha was below the level of detection which correlates to a Radium-226 level below 2 pCi/liter. If yes, special monitoring and recycling conditions will be included in the permit to track any potential problems in landapplying sludge from this facility						
Is a priority pollutant scan required? No Priority pollutant scans are required once every 10 years at facilities with design flows between 5 MGD and 40 MGD, and once every 5 years if design flow is greater than 40 MGD.						

Sample Point Number: 002- MUNICIPAL SLUDGE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Annual	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Annual	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Annual	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Annual	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Annual	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Annual	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Annual	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Annual	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Annual	Composite	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Mercury Dry Wt	Ceiling	57 mg/kg	Annual	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Annual	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Annual	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Annual	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Annual	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Annual	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Annual	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Annual	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Annual	Composite	
Nitrogen, Total Kjeldahl		Percent	Annual	Composite	
Nitrogen, Ammonium (NH4-N) Total		Percent	Annual	Composite	
Phosphorus, Total		Percent	Annual	Composite	
Phosphorus, Water Extractable		% of Tot P	Annual	Composite	
Potassium, Total Recoverable		Percent	Annual	Composite	
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Sampling is required in 2022.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	

Changes from Previous Permit:

No changes from the previous permit. The requirements for land application of municipal sludge are determined in accordance with ch. NR 204 Wis. Adm. Code. Ceiling and high quality limits for metals in sludge are specified in s. NR 204.07(5). Requirements for pathogens are specified in s. NR 204.07(6) and in s. NR 204.07 (7) for vector attraction requirements. Limitations for PCBs are addressed in s. NR 204.07(3)(k).

4 Compliance Schedules

Explanation of Compliance Schedules

Compliance schedules are not required this permit term.

Attachments:

Water Flow Schematic(s)

"Water Quality-Based Effluent Limitations for the City of Tomahawk (WI-0021946)" memo dated July 13, 2018

Proposed Expiration Date:

December 31, 2023

Justification Of Any Waivers From Permit Application Requirements

N/A – All samples have been taken

Prepared By:

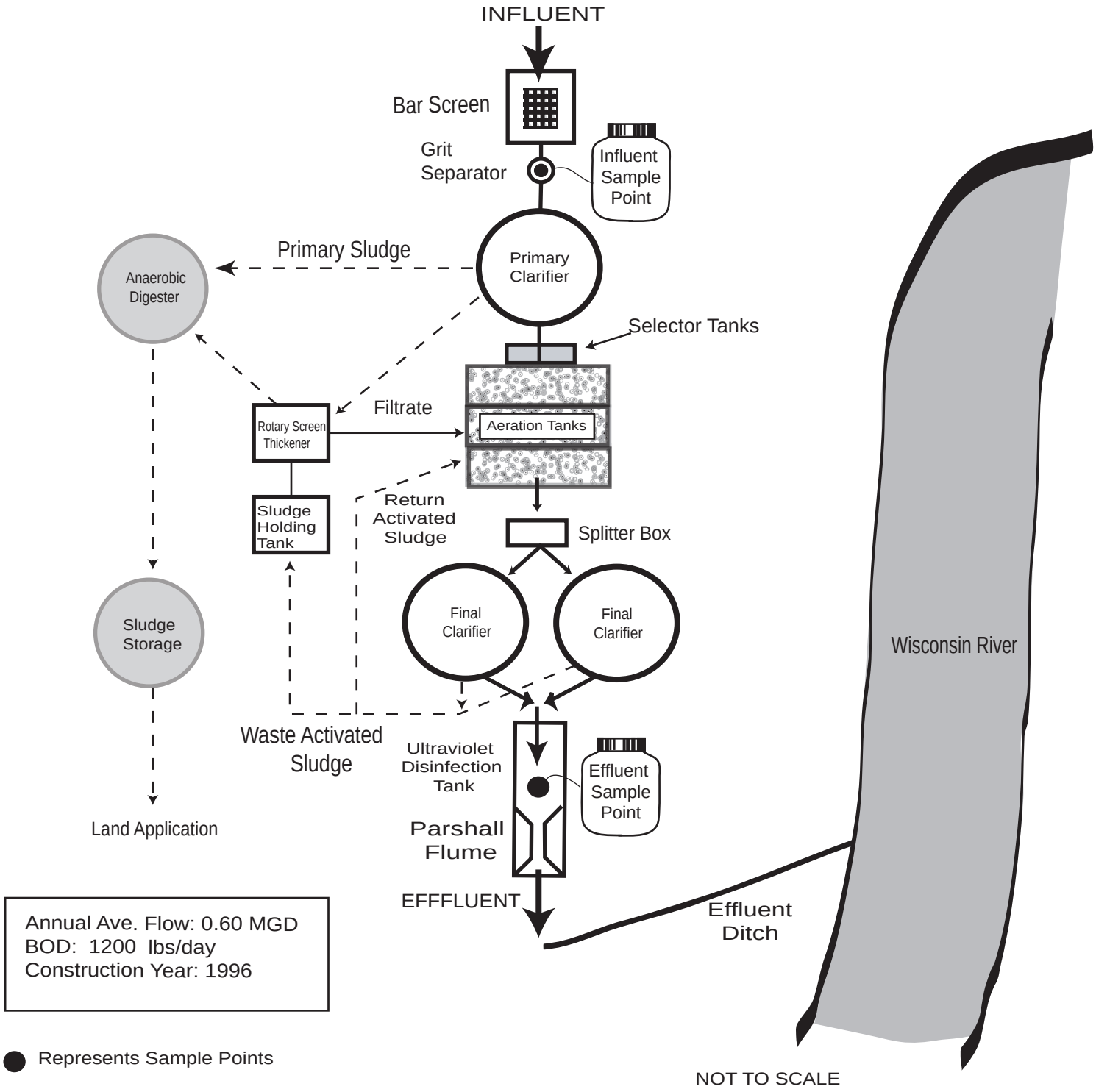
Sheri A. Snowbank Wastewater Specialist

Date: October 1, 2018

cc: Austin Grieshbach and Steve Ohm

CITY OF TOMAHAWK
Wastewater Treatment Facility

The Tomahawk wastewater treatment facility is a conventional activated sludge plant that includes screeing, grit removal, primary settling, aeration, secondary settling, biological and chemical phosphorus removal, seasonal ultraviolet disinfection anaerobic digetion, sludge thickening, and sludge storage. The treated effluent is discharged to an effluent ditch flowing into the Wisconsin River. The diagram below shows the treatment units and sampling locations.



CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: July 13, 2018 FILE REF: 3200

TO: Sheri Snowbank, NOR – Spooner

FROM: Adrian Stocks – WY/3

SUBJECT: Water Quality-Based Effluent Limitations for the City of Tomahawk
WPDES Permit No. WI-0021946-10-0

This is in response to your request for an evaluation of the need for water quality-based effluent limitations using Chapters NR 102, 104, 105, 106, 207, 210 and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the City of Tomahawk wastewater treatment facility in Lincoln County. This municipal wastewater treatment facility (WWTF) discharges to an effluent ditch tributary to the Wisconsin River, located in the Noisy and Pine Creeks Watersheds in the Upper Wisconsin River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

No changes are recommended in the permit limitations for BOD_5, Total Suspended Solids, Dissolved Oxygen, Ammonia, and pH. Based on our review, the following recommendations are made on a chemical-specific basis:

Outfall 001

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
BOD_5			30 mg/L	20 mg/L	1
TSS			30 mg/L	20 mg/L	
pH	9.0 s.u.	6.0 s.u.			
Dissolved Oxygen		4.0 mg/L			
Fecal Coliforms May – September			**656#/100 mL geometric mean**	400#/100 mL geometric mean	2
Ammonia Nitrogen					3
Copper					4
Chloride					3
Phosphorus				1.0 mg/L	5
WET					4

Footnotes:

1. The current permit also contains waste load allocation limits based on ch. NR 212 which are in effect from May through October. These limits should be retained in the reissued permit with no changes recommended to the limits.
2. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold and are discussed further in Part 8.
3. Monitoring only. Monthly monitoring in the fourth year of the permit with enough sampling to ensure that a minimum of 11 data points is available at the next permit issuance.
4. An evaluation of the need for a copper limit based on dissolved criteria was considered in Attachment #3 and a limit is not recommended. Quarterly effluent monitoring is recommended throughout the permit term. The following monitoring is recommended to confirm dissolved copper limits at the next permit issuance. This monitoring is recommended in the fourth year of the permit term following an evaluation of the effluent data.
    - At least two rounds of monitoring of total suspended solids and both total recoverable

and filterable metals (copper) in the effluent and receiving water would be needed. This information would be used to further verify a site-specific translator for each metal. The monitoring (grab sampling) should take place at a point downstream *prior to* the Wisconsin River that is representative of mixed receiving water and effluent, where chemical equilibrium has been reached. Monitoring in the Wisconsin River is not required due to the fact that there isn't reasonable potential to exceed the water quality criteria in the Wisconsin River considering the available dilution.

5. A Total Maximum Daily Load (TMDL) is being developed for the Wisconsin River to address phosphorus water quality impairments within the TMDL area. This TMDL will likely result in limitations for phosphorus that must be included in WPDES permits, which may be different than those calculated for this reissuance. TMDL-derived limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Diane Figiel at (608) 264-6274 or Diane.Figiel@wisconsin.gov.

Attachments (4) – Narrative, Ammonia Limit Calculations, Dissolved Metals Evaluation & Map

PREPARED BY: John Dougherty

APPROVED BY: _____ Date: _____
Diane Figiel, PE,
Water Resources Engineer

E-cc: Steve Ohm, Wastewater Engineer – NOR, Rhinelander

Attachment #1

Water Quality-Based Effluent Limitations for
City of Tomahawk

WPDES Permit No. WI-0021946-10-0

Prepared by: John Dougherty WY/3

PART 1 – BACKGROUND INFORMATION

Facility Description: The City of Tomahawk owns and operates a domestic wastewater treatment system. The plant is designed to treat 600,000 gallons per day. The plant is a conventional activated sludge system. The system begins with a mechanically cleaned fine screen, manual bar screen (when fine screen is bypassed), and a vortex grit removal system. The next unit is a primary clarifier where solids within the wastewater settle. To increase the plants biological phosphorus removal, the wastewater flows into two selector tanks prior to the three aeration basins with return activated sludge, which decreases organic matter and increases biological phosphorus uptake. Activated sludge is composed of settled solids that contain naturally occurring bacteria. The wastewater is then pumped into final clarifiers where additional settling may occur. The plant can add chemicals to further decrease the phosphorus concentration at this point. The settled solids from the clarifiers is rotary thickened and then pumped to anaerobic digesters to stabilize the sludge and reduce the harmful bacteria to safe levels. Sludge is stored on site until it can be land applied at DNR approval land disposal sites.

Prior to discharge, treated wastewater is exposed to ultraviolet light seasonally (May-September) as a disinfectant. The effluent is then discharged to wetland South of the facility where it flows ½ mile to the Wisconsin River along a constructed channel.

Attachment #3 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations: The current permit, which expired on June 30, 2018, includes the following effluent limitations.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
BOD_5			30 mg/L	20 mg/L	1.2
TSS			30 mg/L	20 mg/L	1
pH	9.0 s.u.	6.0 s.u.			1
Dissolved Oxygen		4.0 mg/L			1
Fecal Coliforms May – September				400#/100 mL (geometric mean)	
Ammonia Nitrogen					3
Phosphorus				1.2 mg/L	
Temperature					3

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria, reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. The current permit also contains waste load allocation limits based on ch. NR 212 which are in effect from May through October. No changes are recommended to the WLA limits in the current permit.
3. Monitoring only

Receiving Water Information:

- Name: Effluent ditch tributary to the Wisconsin River
- Classification: Limited Aquatic Life (LAL), non-public water supply.
  Approximately ½ mile downstream the Wisconsin River is classified as a warm water sport fish community
- Low Flow: The 7-Q_{10} and 7-Q_2 values are zero at the point of discharge.
  The following 7-Q_{10} and 7-Q_2 values apply for the Wisconsin River at the Tomahawk dam:
  7-Q_{10} = 750 cfs (cubic feet per second)
  7-Q_2 = 1190 cfs
- Hardness = 110 mg/L (The effluent hardness is used in place of the receiving water hardness because the low flow of the receiving water is zero.)
- % of low flow used to calculate limits: not applicable at point of discharge because low flow is zero, 25% mixing applies to the Wisconsin River
- Source of background concentration data: Background concentrations are not included since they don't impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: Packaging Corporation of America discharges to the Wisconsin River, this does not impact the calculation of limits for Tomahawk due to the high flow of the River
- Impaired water status: Downstream, Lake DuBay is phosphorus impaired. A phosphorus TMDL for the Wisconsin River is currently under development.

Effluent Information:

- Design Flow Rate(s): The annual average design flow was increased from 0.49 MGD for the previous limit memo.
  Annual average = 0.60 MGD (Million Gallons per Day)
  Peak daily = 1.27 MGD
  Peak weekly = 1.01 MGD
  Peak monthly = 0.726 MGD
  For reference, the actual average flow from January 2013 to January 2018 was 0.587 MGD.
- Hardness = 110 mg/L as $CaCO_3$. This value represents the geometric mean of data from the permit application.
- Effluent characterization: This facility is categorized as a minor municipality so the permit application required effluent sample analyses for a limited number of common pollutants, primarily metal substances plus Ammonia, Chloride, Hardness and Phosphorus.

Sample Date	Zinc µg/L	Copper µg/L
19-April-2018	37	3.9
22-April-2018	40	6.9
25-April-2018	30	3.0
29-April-2018	38	6.9
16-May-2018	33	12
19-May-2018	36	6.1
22-May-2018	32	4.9
24-May-2018	32	5.1
27-May-2018	34	5.3
30-May-2018	33	5.4
3-June-2018	29	5.9
1-day P_{99}	42.69	13.3
4-day P_{99}	38.15	9.15

Sample Date	Chloride mg/L	Sample Date	Chloride mg/L	Sample Date	Chloride mg/L
*	73	*	71	08/22/2001	68
*	79	*	73	10/31/2017	150
*	85	*	76	11/03/2017	130
*	71	10/04/2000	62	11/12/2017	130
*	72	01/07/2001	80	11/15/2017	130
*	63	06/27/2001	71		
1-day P_{99} = 167.15 µg/L					
4-day P_{99} = 121.86 µg/L					

* Data used in previous evaluation did not include sample date

The following table presents the average concentrations and loadings at Outfall 001 from January 2013 to January 2018 for all parameters with limits in the current permit:

	Average Measurement	Average Mass Discharged
Flow Rate	0.587 MGD	
BOD_5	7.02 mg/L	34.4 lbs/day*
TSS	5.94 mg/L	29.1 lbs/day*
pH field	7.2 s.u.	
Dissolved Oxygen	4.7 mg/L	
Fecal Coliform	10.8 #/100mL	
Phosphorus	0.39 mg/L	1.9 lbs/day*
Ammonia Nitrogen	0.07 mg/L	
Temperature	53.9 °F	

*Average mass discharged was calculated by multiplying the average effluent concentration by the annual average flow since mass discharged for each of the substances above was not sampled for. The average annual flow used to calculate the mass discharged is: 0.587 MGD.

- Water Source: City of Tomahawk Wells
- Additives: Caustic and fluoride used at water supply, no additives are used at the WWTF

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

In general, permit limits for toxic substances are recommended whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q_{10}

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

WQC =Acute toxicity criterion or secondary acute value according to ch. NR 105

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q_{10})
if the 1-day Q_{10} flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q_{10}).

Qe = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d)

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e).

As a rule of thumb, if the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} method of limit calculation probably produces the most stringent daily maximum limitations, and should be used while making reasonable potential determinations.

The following tables list the water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in term of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)
RECEIVING WATER FLOW = 0 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})).

SUBSTANCE	REF. HARD.* mg/L	ATC	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Arsenic		339.8	339.8	67.96	<1.0		
Cadmium	110	32.2	32.2	6.44	<1.0		
Chromium	110	1946.43.	1946.3	389.89	<0.67		
Copper	110	16.98	16.98			13.30	12
Lead	110	117.24	117.24	23.45	<1.5		
Nickel	110	508.57	508.57	101.71	2.20		
Zinc	110	130.84	130.84			42.69	40
Chloride - mg/L		757	757			167.15	150

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q_{10} flow rates yields a more restrictive limit than the 2 x ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)
RECEIVING WATER FLOW = 0 cfs (¼ of the 7-Q_{10})

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Arsenic		152.2		152.2	30.44	<1.0	
Cadmium	110	1.82		1.82	.36	<1.0	
Chromium	110	96.33		96.33	19.27	<.67	
Copper	**110**	**7.44**		**7.44**			**9.15**
Lead	110	19.29		19.29	3.86	<1.5	
Nickel	110	52.99		52.99	10.6	2.20	
Zinc	110	85.92		85.92			38.15
Chloride - mg/L		395		395			121.86

Monthly Average Limits based on Wildlife Criteria (WC) The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	880		880	176.0	<1.0
Chromium (+3)	8400000		8400000	1680000	<.67
Lead	2240		2240	448.0	<1.5
Nickel	110000		110000	22000	2.20

Monthly Average Limits based on Human Cancer Criteria (HCC)

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	40		40	8	<1.0

Because effluent data is available for only one substance for which Human Cancer Criteria exists, and it was not detected in the effluent, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are apparently needed for copper.

Copper: There is reasonable potential that chronic toxicity criteria could be exceeded and therefore **a weekly average limit of 7.4 µg/L is recommended for copper along with mass limits.** The total recoverable copper limit is evaluated further in Attachment #3 based on dissolved criteria.

Chloride: The 1-day and 4-day P_{99}s of the chloride concentration is less than the calculated daily maximum and weekly average WQBELs, therefore no effluent limits are needed. However, given the fact that older data was used to calculate the P_{99}'s and the dates of that data are unknown, monthly monitoring in the fourth year of the permit term is recommended

Mercury: The permit application did not require monitoring for mercury because the City of Tomahawk is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., a minor municipal discharger shall monitor and report results of influent and effluent mercury monitoring once every three months if, "there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5)." A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from May 2013 to April 2017 was 1.82 mg/kg, with a maximum reported concentration of 6.2 mg/kg. Therefore, no mercury monitoring is recommended at Outfall 001.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for Ammonia Nitrogen effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit does not have ammonia nitrogen limits. The limits calculated in 2013 and provided in attachment #2 are re-evaluated at this time due to the following changes:

- Updates to subchapter IV of ch. NR 106, Wis. Adm. Code allow limits based on available dilution instead of limits set to twice the acute criteria.
- Seasonal 20 and 40 mg/L thresholds for ammonia limits are no longer applicable under current rules.

There are no changes to the calculated weekly and monthly average ammonia limits because there have been no changes in the effluent and receiving water flow rates. As with the previous permit issuance,

weekly and monthly limits are not recommended. (See attachment #2)

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)
Updates to subchapter IV of Ch. NR 106, Wis. Adm. Code (effective September 1, 2016) outline the option for the Department to implement use of the 1-Q_{10} receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. Since the Qs:Qe ratio is less than 2:1; the 2×ATC method will yield a less stringent limit. Therefore, the limits based upon the 1-Q_{10} receiving water are calculated.

Daily maximum limitations are based on acute toxicity criteria, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warmwater Sport fishery, and
A = 0.633 and B = 90.0 for Limited Aquatic Life, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data for the past five years was examined as part of this evaluation. A total of 1857 sample results were reported from January 2013 through January 2018. The maximum reported value was 7.40 s.u. (Standard pH Units). More than 99% of the time the pH was 7.26 s.u. or less. The 1-day P_{99}, calculated in accordance with s. NR 106.05(5), is 7.26 s.u. And the mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.245 s.u. A value of 7.26 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.26 s.u. into the equation above yields an ATC = 42.44 mg/L and a computed daily maximum limit of 42.44 mg/L for limited aquatic life communities and ATC = 27.54 mg/L and a computed daily maximum limit of 55.08 mg/L for warm water sport fish community.

Section NR 106.33(2) was updated effective September 1, 2016. As a result, seasonal 20 and 40 mg/L thresholds for including ammonia limits in municipal discharge permits are no longer applicable under current rules. As such, s. NR 106.33(1) enables the Department to determine the need to include ammonia limits in municipal discharge permits based on the statistical comparisons in s. NR 106.05.

Effluent Data
Ammonia nitrogen effluent data from 2016 results were as follows:

Sample Date	Ammonia Nitrogen mg/L
02/29/2016	0.062
05/31/2016	0.06
08/23/2016	0.075
11/27/2016	0.066
Mean	0.0658

Conclusions and Recommendations
In summary, there are no current limits which were included in the recent permit term. There have been no changes to the treatment processes or river flows. In addition, given the monitoring data that was included in the permit application and over the past permit term, there is no reasonable potential that limits could be exceeded. For those reasons, there are no limits recommended at this time.

PART 4 –PHOSPHORUS

Technology Based Effluent Limit (TBL) Wisconsin Administrative Code, ch. NR 217, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a Monthly Average limit of 1.0 mg/L, or an approved Alternative Concentration limit. The City of Tomahawk currently has an existing alternative phosphorus based of 1.2 mg/L based on biological phosphorus removal, which was granted on August 12, 1998.

The facility has been able to reduce their phosphorus discharges since the alternative phosphorus limit was granted in 1998. The need for an alternative phosphorus limit for the City of Tomahawk no longer exists. As such, the 1.0 mg/L technology based effluent limit (TBL) is recommended.

Effluent Data
The following table summarizes effluent total phosphorus monitoring data from January 2013 to January 2018. The data suggest that a compliance schedule will not be necessary for the facility to meet the technology based phosphorus limit of 1.0 mg/L.

	Phosphorus mg/L
1-day P_{99}	1.68
4-day P_{99}	0.93
30-day P_{99}	0.54
Mean	0.37
Std	0.34
Sample size	793
Range	.09-3.3

Water Quality-Based Effluent Limits (WQBEL)
Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to ch. NR 102 (s. NR 102.06), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III) establish procedures for determining water quality based effluent limits for phosphorus, based on the applicable standards in ch. NR 102. Phosphorus criteria in s. NR 102.06 do not apply to limited aquatic life waters [s. NR 102.06 (6) (d)].

These waters were not included in the USGS/WDNR stream and river studies and, therefore, the Department lacked the technical basis to determine and propose applicable criteria. At some time in the future, the Department may adopt phosphorus criteria based on new studies focusing on limited aquatic life waters. The guidance suggests that during the interim, water quality based effluent limitations should be based on the criteria and flow conditions for the next stream segment downstream (or downstream lake

or reservoir, if appropriate). The discharge location of the wastewater from the City of Tomahawk is classified as limited aquatic life downstream from the point of discharge downstream to the Wisconsin River. The Wisconsin River is classified for warm water sport fishery uses.

The conservation of mass equation is described in s. NR 217.13 (2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs):

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where: WQC = 0.1 mg/L for Wisconsin River.
Qs = 100% of the 7-Q_2 of 1190 cfs
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.6 MGD = 0.928cfs
f = the fraction of effluent withdrawn from the receiving water = 0

Section NR 217.13(2)(d), Wis. Adm. Code, specifies that the background phosphorus concentration used in the limit calculation formula shall equal the median of at least four samples collected during the months of May through October, and that all samples collected during a 28-day period shall be considered as a single sample and the average of these concentrations used to determine a median. Averaging begins at date of the first sample in the range of May through October.

A review of all available in stream total phosphorus data from May 2010 to October 2013 stored in the Surface Water Integrated Monitoring System database indicates the median background total phosphorus concentration in Wisconsin River at Herb Mitchel Landing (SWIMS ID: 10031133) is 0.067 mg/L, just downstream from the point of discharge to the Wisconsin River.
The following data were considered in estimating the background phosphorus concentration (phosphorus data is in mg/L):

SWIMS ID	353182	10031133	353376
Station Name	Monitoring station at Spirit River at Hwy E	Monitoring station at WI River – Herb Mitchell	Monitoring station at WI River Site 57
Waterbody	Spirit River	WI River	Grandfather Flowage
Sample Count	48	55	7
First Sample	05/09/2010	05/09/2010	05/19/2003
Last Sample	10/28/2013	10/28/2013	10/13/2003
Median	0.0715 mg/L	0.066 mg/L	0.052 mg/L
NR 217 Rolling Median	0.074583 mg/L	0.067 mg/L	0.054 mg/L

Substituting a median value of 0.067 mg/L into the limit calculation equation above, the calculated limit is 42.4 mg/L. Because the TBL phosphorus limit is more stringent than the calculated phosphorus WQBEL, the recommended limit is 1.0 mg./L as a monthly average.

TMDL Under Development
A Total Maximum Daily Load (TMDL) is being developed for the Wisconsin River Basin. The TMDL will address phosphorus water quality impairments within the basins and provide waste load allocations (WLA) required to meet water quality standards. This TMDL will likely result in phosphorus limitations that must be included in WPDES permits, which may be different than those calculated in this WQBEL memo. TMDL-derived phosphorus limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.

PART 5 –THERMAL

New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in Chapters NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The daily maximum effluent temperature limitation shall be 86 °F for discharges to surface waters classified as Limited Aquatic Life according to s. NR 104.02(3)(b)1, except for those classified as wastewater effluent channels and wetlands regulated under ch. NR 103 [s. NR 106.55(2), Wis. Adm. Code] which have effluent temperature limitations of 120 ºF.

Reasonable Potential
Based on the available discharge temperature data from February 2016 to January 2017 shown below, the maximum daily effluent temperature reported was 67 °F; therefore, no reasonable potential for exceeding the daily maximum limit exists, and **no limits or monitoring are recommended**.

Month	Representative Highest Monthly Effluent Temperature	**Calculated Effluent Limit**
	Daily Maximum (°F)	**Daily Maximum Effluent Limitation** (°F)
JAN	48	120
FEB	44.6	120
MAR	46.8	120
APR	49.1	120
MAY	61.7	120
JUN	61.4	120
JUL	65.6	120
AUG	67	120
SEP	67	120
OCT	64	120
NOV	59	120
DEC	54	120

Downstream impacts: Due to the high dilution, there is no reasonable potential to exceed the water quality

criteria in the Wisconsin River.

PART 6 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. The following evaluation is based on procedures in the Department's WET Program Guidance Document (revision #11, dated November 1, 2016).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent.

- Chronic testing is usually not recommended where the ratio of the 7-Q_{10} to the effluent flow exceeds 100:1. For the City of Tomahawk that ratio is approximately 808:1. With this amount of dilution, there is believed to be little potential for chronic toxicity effects in the Wisconsin River associated with the discharge, so the need for chronic WET testing will not be considered further.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.

The WET Checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other permit conditions. The Checklist steps the user through a series of questions that evaluate the potential for effluent toxicity. The Checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code, and recommends monitoring frequencies based on points accumulated during the Checklist analysis. As toxicity potential increases, more points accumulate and more monitoring is recommended to ensure that toxicity is not occurring. The completed WET Checklist recommendations for this permittee are summarized in the table below. Staff recommendations, based on the WET Checklist and best professional judgment, are provided below the summary table. For guidance related to RP and the WET Checklist, see Chapter 1.3 of the WET Guidance Document: http://dnr.wi.gov/topic/wastewater/WETguidance.html.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not Applicable. **0 Points**	IWC = %. 0 **Points**
Historical Data	Tests used to calculate RP = 0 Tests failed = 0 **5 Points**	Tests used to calculate RP = 0 Tests failed = 0 **5 Points**
Effluent Variability	Little variability, no violations **0 Points**	Same as Acute.

		0 Points
Receiving Water Classification	Full Fish & Aquatic Life or < 4 mi to non-variance water **0 Points**	Same as Acute. **0 Points**
Chemical-Specific Data	Limits for no substances based on ATC; copper, zinc, nickel, chloride and ammonia detected. Additional compounds of concern: 0 **0 Points**	Limits for copper based on CTC; zinc, nickel, chloride, and ammonia detected. Additional compounds of concern: 0 **5 Points**
Additives	0 Biocides and 0 Water Quality Conditioners added. SorbX-100 Used: No 0 **Points**	No additives used 0 **Points**
Discharge Category	0 Industrial Contributors. **0 Points**	Same as Acute. **0 Points**
Wastewater Treatment	Secondary or Better **0 Points**	Same as Acute. **0 Points**
Downstream Impacts	No impacts known **0 Points**	Same as Acute. **0 Points**
Total Checklist Points:	**13 Points**	**18 Points**
Recommended Monitoring Frequency (from Checklist):	None	None
Limit Required?	No Limit = Not applicable	No Limit = Not applicable
TRE Recommended? (from Checklist)	No	No

- Following the guidance provided in the Department's WET Program Guidance Document (revision #11, dated November 1, 2016), based upon the point totals generated by the WET Checklist, other information given above, and Chapter 1.3 of the WET Guidance Document, no WET testing would be recommended in the reissued permit. The consideration of a dissolved copper limit, and dropping the copper limit would result in the need for WET testing.

- Whole effluent toxicity testing is suggested as part of the dissolved-based metals limit process. Due to the fact that the Qs:Qe ratio is greater than 100:1 and less than 1000:1, annual acute whole effluent testing would be recommended where no tests are currently recommended. However with the LAL classification at the point of discharge, no acute testing is required. Chronic WET testing is also not required as the frequency would be unaffected due to the large amount of dilution.

PART 7 – EXPRESSION OF LIMITS

Revisions to ch. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limitations with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

The City of Tomahawk is a POTW, and is therefore subject to weekly and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in s. NR 106.07, Wis. Adm. Code and or s. NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with s. NR 106.07 or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, and pH, among other parameters.

Additional limitations needed to comply with s. NR 106.07 Expression of limits:

Parameter	Weekly Geometric Mean	Monthly Geometric Mean	Multiplication Factor (CV)	Assumed Monitoring Frequency (n)
Fecal Coliform May - Sept	**656 #100 ml**	400 #100 ml	1.64 (0.6)	Weekly (4)

Method for calculation: Method 3 described below

The methods for calculating limitations for continuous discharges subject to ch. NR 210.to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), and are as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
2. Whenever a weekly average limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
3. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

   Weekly Average Limitation = (Monthly Average Limitation x MF)

   Where:

   MF = Multiplication factor as defined in Table 1

   CV = coefficient of variation (CV) as calculated in s. NR 106.07(5m)

   = 0.6 for fecal coliform

n = the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6)

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	**1.64**	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Attachment #2

Ammonia Limit Calculations from 01/31/2013 WQBEL Memo

Ammonia Limit Calculations Summary – City of Tomahawk				
Classification: EFFLUENT FLOW (MGD): MAX. EFFLUENT pH (s.u.):	LAL 0.49 7.22	(Eff. ditch to WI River) (Design Flow) (1-day P_{99} of 1999 to 2012 data)		
	Effluent Ditch - LAL		Wisconsin River - WWSF	
BACKGROUND INFO**:** Ammonia (mg/L, default) Temp. (deg C, default) pH (eff. pH w/ditch & default pH w/river) % of river flow used: Ref. low flows: (0 cfs for ditch, for river use low flows derived for Tomahawk Dam)	Summer NA 25 7.00/6.86 N/A 0 0	Winter NA 3 7.00/6.86 N/A 0 0	Summer 0.04 25 7.79 100 386 652	Winter 0.08 3 7.38 25 96.5 163
CRITERIA (in mg/L): Acute 4-day Chronic 30-day Chronic	Summer 44.49 49.10 20.58	Winter 44.49 202.82 85.01	Summer **NA** 4.10 1.64	Winter NA 12.01 4.80
EFFLUENT LIMITATIONS: Daily max. – no limits recommended Weekly ave. - no limits recommended Monthly ave. – no limits recommended	Summer 89 mg/L 49 mg/L 21 mg/L	Winter 89 mg/L 200 mg/L 85 mg/L	Summer NA 2,100 mg/L 1,400 mg/L	Winter NA 1,500 mg/L 1,000 mg/L
Effluent limits are not required when a calculated limit is more than the corresponding effluent P_{99} value. Effluent ammonia monitoring results reported in 2011 ranged from "not detected" to 1.67 mg/L and averaged 0.7 mg/L. No effluent limits for ammonia are recommended.				

Evaluation of Dissolved-Based Metal Limits

Dissolved-based limits may be evaluated for Tomahawk pursuant to the 1997 revisions to chs. NR 105 and 106. Typically, the first approach in evaluating the need for the dissolved-based limits is to look at the variability of the metals data already provided to the department.

It should be noted that the permittee has not formally requested the evaluation of dissolved-based limits, which normally triggers the consideration of such according to s. NR 106.06(7)(b). Since this request has not been submitted, the dissolved-based limits shall be provided for informational purposes in this Addendum with an explanation of the additional data which the permittee would need to submit to demonstrate that the dissolved-based recommendations belong in the permit.

Information required for the calculation of dissolved-based limits includes the conversion factors from ss. NR 105.05 (5) (for acute criteria) or NR 105.06 (8) (for chronic criteria). Background data is also required to translate the dissolved criteria into a site-specific number (the "translator") from which a total recoverable limit may be calculated based on the fraction of the discharged metal which would be dissolved in the receiving water. To perform this translation the following background data is required:

$$\text{Translator} = \frac{M_{tr}}{M_d}$$

Where:

M_d: Dissolved metals concentration in the receiving water (µg/L)
M_{Tr}: Total Recoverable metals concentration in the receiving water (µg/L)

A dissolved based approach to calculating limits was performed in 2002 using low level copper data taken at the City of Tomahawk. The calculated translator values for both the Wisconsin River and effluent stream are included below. Two rounds of samples were taken for both the receiving water and the effluent. The geometric mean of the two translator values for the receiving water characteristics will be used in the evaluation of increased limits. With the dilution available at the Wisconsin River (7-Q_{10} = 750 cfs) a copper limit is not needed so downstream impacts do not need to be considered.

	Wisconsin River Translator	Effluent Translator
	2.50	5.0
	1.65	3.94
Geomean	**2.03**	**4.44**

Multiplying the effluent translator by the conversion factor from ch. NR 105 and the applicable criterion will give an indication of the amount of "relief" potentially available to the recommended permit limits if the dissolved fraction is considered from the available data:

Translated Criteria = NR 105 Criterion * Conversion Factor * Translator

Copper (Effluent) = 7.4 µg/L * 0.960 * 4.44 = 31.5 µg/L

With a low flow of zero, the weekly average limit is equal to the dissolved based criteria of 31.5 µg/L.

Using the dissolved-based approach for copper limits, the weekly average limit is 32 µg/L (rounded to two significant digits). The 4-day P_{99} is 9.15 µg/L therefore a copper limit is not needed using an evaluation of dissolved based criteria.

The permittee can collect on-site information to support either the estimated dissolved-based criteria or some alternate criteria. If no copper limit is included in the permit based on dissolved criteria, based on the *Water Quality Rules Implementation Plan* (Ch. 4), the following monitoring would be recommended for copper at or near the Tomahawk outfall:

1. At least two rounds of monitoring of total suspended solids and both total recoverable and filterable metals (copper) in the effluent and receiving water would be needed. This information would be used to further verify a site-specific translator for each metal. The monitoring (grab sampling) should take place at a point downstream *prior to* the Wisconsin River that is representative of mixed receiving water and effluent, where chemical equilibrium has been reached.

2. Whole effluent toxicity testing is suggested as part of the dissolved-based metals limit process. Due to the fact that the Qs:Qe ratio is greater than 100:1 and less than 1000:1, annual acute whole effluent testing would be recommended where no tests are currently recommended (chronic WET testing frequency would be unaffected due to the large amount of dilution).

Attachment #3

Aerial View of Tomahawk and Wastewater Treatment Plant Location